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ABSTRACT

This packet contains four science learning activities on the subject of animal science that can be used in agricultural education courses. The activities cover these topics: (1) identifying internal parasites in domestic livestock; (2) the effect of feed preparation on feed palatability and consumption; (3) determining the absorption abilities of agricultural bedding materials; and (4) comparing and contrasting plant and animal cells. The lesson plans for the activities consist of the following elements: agricultural subjects and science principles included in the lesson, agricultural applications, student objectives, activity length, intended group size, vocabulary terms, materials required, instructional strategies and procedures (overview and results), key questions, and evaluation. One to three references are given for each activity, and a data record and observation sheet are included. (KC)

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AGRICULTURAL EDUCATION SCIENCE ACTIVITY
Nos. AS 1-4

Ohio Agricultural Education Curriculum Materials Service
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CE057452

Agricultural Subject

- Animal Science

Activity Length

- One class period

Group Size

- This activity can be conducted with the entire class or small groups (2 to 3 students).

Science Principle

- **Pathology:** All living organisms have parasites that can affect their life processes. The degree to which organisms are affected depends on the susceptibility of the host, the nature of the parasite, and the environment.

Agricultural Application

- Internal parasites are destructive to animals of all species. However, young animals are more susceptible and may be severely affected by parasites. Animals may be affected in several ways:

1. Parasites can retard growth, development, and performance.
2. Parasites can decrease disease resistance.
3. Parasites can cause tremendous economic loss, poor health, discomfort, and even death.

Therefore, agriculture students must be able to determine if an animal is host to a parasite.

Agricultural Education Science Activity – No. AS-1

Identifying Internal Parasites in Domestic Livestock

Student Objective

- To determine if domestic livestock (swine) are infected with internal parasites. This demonstration deals with **helminths** - commonly called **worms** (specifically, nematodes - roundworms).

Vocabulary

parasite	intermediate host	roundworm
definitive host	viable emaciation	helminth
host-specific	nematode	ascarid
anemia		

Materials Required

1. Disposable gloves
2. Fresh swine fecal specimens (thumbnail size)
3. Small clean pill bottle or similar container
4. Super-saturated sodium nitrate solution
5. Microscope slides with coverslips
6. 40 x 10 microscope
7. Paper and pen for recording results

Instructional Strategies and Procedures

- **Overview**: Collect fecal specimen and place in bottle. After filling bottle with super-saturated sodium nitrate solution, collect roundworm eggs on slide. Observe under microscope. Discuss your observations.

1. Put on disposable gloves and collect a fresh fecal specimen from the hog pen. (Discuss the effects of using a sample that is not fresh.) The specimen can be the size of your thumbnail.
2. Place the specimen in a pill bottle. Completely fill the bottle with super-saturated sodium nitrate solution. The roundworm eggs will float to the top of this solution.
3. Place a microscope slide on the bottle opening. The eggs will adhere to the slide. Put a coverslip on the slide.
4. Position the slide under a microscope. Compare what you see through the microscope to a picture of an actual roundworm egg (see Figures 1 and 2). Otherwise, you could mistake an air bubble for an egg. Record your observations on page 4.

Instructional Strategies and Procedures

(continued)

■ **Results**: If the animals have not been recently wormed, there should be eggs present in your specimen. Discuss the various ways livestock can be wormed. Although effective worming kills 99.9% of the adult worms, it does not affect the larva or eggs. Therefore, worming should be repeated 21 days after the first treatment. Collect another specimen after the first treatment to show the importance of the second worming.

Figure 1. Roundworm eggs viewed through a microscope at low power.

Figure 2. Roundworm eggs viewed through a microscope at high power.

Key Questions

1. How do livestock become infested with parasites?
2. What is the life cycle of the large roundworm (ascarid)? (See Figures 3 and 4.)
3. What are some ways to worm livestock?
4. How can reinfestation be prevented?
5. Why is a prevention program important?

Evaluation

■ Ask students to write a report based on what they have observed.

Bibliography

1. Rice, Duane. *Animal Disease*. 4-H Veterinary Science Unit II. Nebraska Cooperative Extension Service.
2. Koutz, Fleetwood R. (Sr.) *Identification and Life Cycles of Parasites Affecting Domestic Livestock*. Columbus, OH: University Publications Sales, 1967.
3. Poland, Jeff. Doctor of Veterinary Medicine. Coshocton, OH: personal interview.

Figure illustrations adapted by Jenny Rohrer from *Identification and Life Cycles of Parasites Affecting Domestic Livestock* (see above).

Experiment submitted by Robert Buxton, Agriculture Education Instructor, River View High School, Warsaw, OH 43844.

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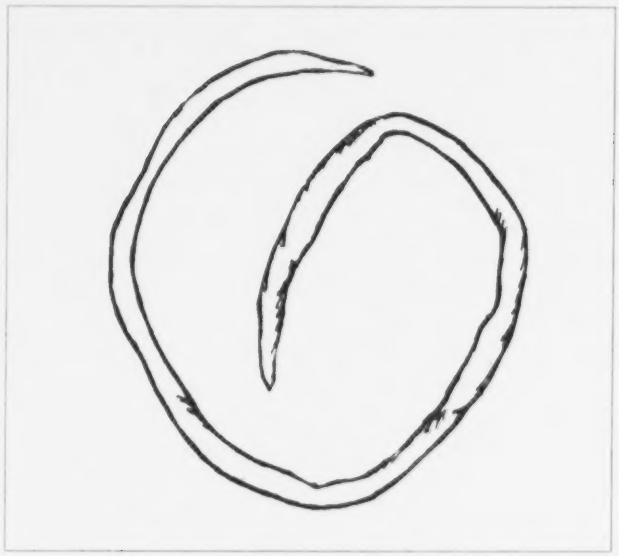

Figure 3. *Ascaris lumbricoides*, the common ascarid of swine. Found in small intestine.

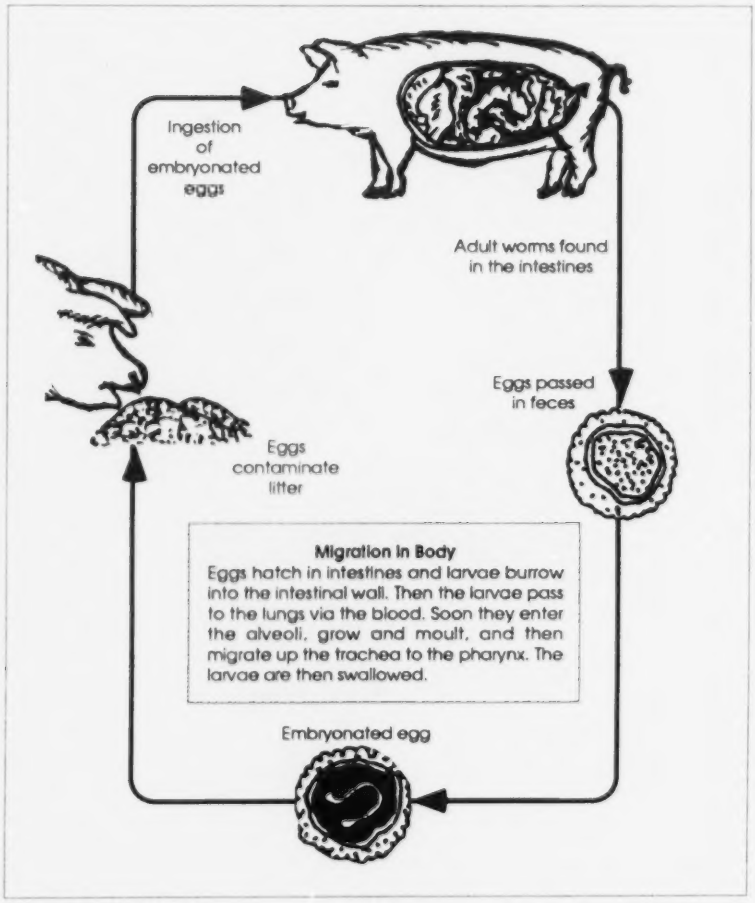
Ingestion of embryonated eggs
Adult worms found in the intestines
Eggs passed in feces
Eggs contaminate litter
Migration in Body
Eggs hatch in intestines and larvae burrow into the intestinal wall. Then the larvae pass to the lungs via the blood. Soon they enter the alveoli, grow and moult, and then migrate up the trachea to the pharynx. The larvae are then swallowed.
Embryonated egg

Figure 4. Life cycle of *Ascaris lumbricoides*

DATA RECORD AND OBSERVATION SHEET

Name _____ Date _____ Period _____

Identifying Internal Parasites in Domestic Livestock

Objective

Procedure

Observations and Results

Conclusions

Agricultural Education Science Activity – No. AS-2

The Effect of Feed Preparation on Feed Palatability and Consumption

Agricultural Subjects

- Animal Science
- Swine Nutrition

Activity Length

- Four to five days. Allow 30 minutes twice a day for conducting experiment and recording data.

Group Size

- This activity can be conducted with an entire class.

Science Principles

- **Animal digestion and nutrition**: The benefit an organism derives from its food is dependent upon the composition and nutritive value of the food and the ability of the organism to use the food.
- **Irritability and tropisms**: All living organisms have an innate tendency to respond to stimuli.

Agricultural Application

- Today's swine producer is under pressure to get his/her product to market as quickly and economically as possible. During this process the producer must decide how to prepare the feed so it is most palatable to the hogs. Food palatability ensures that hogs consume adequate amounts of food, therefore, receiving proper nutrition.

It is important that agriculture students raising hogs for their SAE give their animals a good nutritional start. This is especially true if the animals are to be entered in a county fair or show. These students need a basic understanding of food palatability and the importance this plays in hog production.

Student Objective

- To determine if feed preparation influences feed palatability and consumption.

Vocabulary

free choice
complete feed
feed intake
liquid feed
self feeding
pellet feed
paste feed
grinding
protein supplement
growth rate

Materials Required

1. Three to four market hogs (75 to 100 pounds each)
2. A facility that includes the following:
   - One large holding pen with water source
   - Three to four small feeding pens - one for each pig
3. One sample each of the following feed preparations:
   - Complete feed
   - Pellet feed
   - Paste feed - one part feed to 1.2 - 1.5 parts water by weight
   - Liquid feed - Feed to water ratio can vary, but feed should be "runny."
   - Shelled corn (*not* ground and supplement)
   - Ground ear corn and supplement
4. Six feed pans for each pig
5. One clean water pan in each pen
6. Paper and pen

Instructional Strategies and Procedures

- **Overview**: Select three to four market pigs, 75 to 100 pounds each. Place them in a holding pen with clean water. Twice a day for four to five days, transfer the pigs to separate feeding pens. Give each pig free choice of six different feeds and clean water. Allow them to consume as much as they want. After feeding, return them to the holding pen. Note the order in which they choose the feeds and the amount of each feed consumed. Record observations and discuss results.

Instructional Strategies and Procedures

(continued)

1. Select three to four market pigs weighing 75 to 100 pounds each. Number the pigs and place them in a large holding pen. Make sure there is clean water in the pen.
2. Set up one small feeding pen for each pig as shown in Figure 1.
3. Measure equal amounts of the following feed preparations:
   - Complete feed
   - Pellet feed
   - Paste feed - one part feed to 1.2 - 1.5 parts water by weight
   - Liquid feed - feed to water ratio can vary, but feed should be "runny"
   - Shelled corn (*not* ground and supplement)
   - Ground ear corn and supplement
4. Place six feed pans in each feeding pen. Position the feed pans at the end farthest from the pen entrance (see Figure 2). Place each feed preparation in a separate pan. Also place clean water in each pen.
5. Transfer one pig to each feeding pen.
6. Permit the pigs to consume as much feed and water as they want (free choice). Allow plenty of time for this. Note the order in which the feeds are chosen. Record this information on page 3.
7. After the pigs have consumed all the feed they want, return them to the holding pen.
8. Measure the quantity of feed each pig consumed from each pan. Record this on page 3.
9. Using the procedure outlined in steps 1 through 8, feed the pigs twice a day for four to five days (or as long as needed to reach a conclusion). *Rearrange the feed pans at each feeding.* This ensures that each pig will choose the feed it prefers rather than simply returning to the same eating location.
10. Complete pages 4 and 5.

■ **Results**: This demonstration shows that pigs prefer the paste or liquid feed over the other feeds. If the paste or liquid feeds were eliminated, the pigs would prefer the complete feed, followed by ground ear corn and supplement, shelled corn, and finally pellets. Feed preparation does influence feed palatability which, in turn, increases feed consumption. Ultimately, the pig's growth rate also increases.

Note: When using the liquid or paste feed, actual feed consumption can be increased or decreased by controlling the amount of water in the ration.

Demonstration submitted by Jeff Shoup, Production Agriculture Instructor, Franklin-Monroe High School, Pitsburg, OH 45358.

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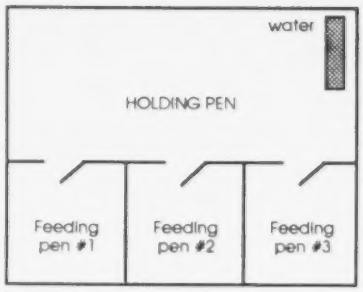

Figure 1. Pen set-up for three pigs: one holding pen with three adjoining feeding pens.

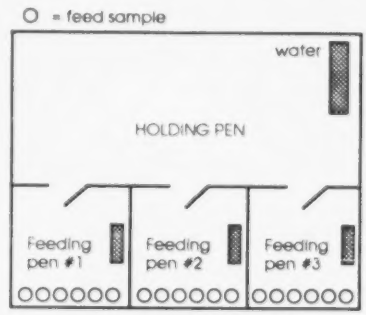

Figure 2. Place feed samples in each pen at the end farthest from pen entrance.

Key Questions

1. Which type of feed is most commonly fed to market hogs? Why?
2. Why are ground cobs not desired in feed for market hogs?
3. Why is corn usually ground in feed for market hogs?
4. Besides water, what else could be used as the liquid in rations for market hogs?
5. Why is free-choice water necessary when feeding market hogs?

Evaluation

■ Ask students to write a report based on what they have observed.

Bibliography

"Physical Forms of Feed - Feed Processing for Swine," *Pork Industry Handbook*. Cooperative Extension Service, The Ohio State University, Columbus, OH:

DAY AND FEEDING	PIG 1		PIG 2		PIG 3		PIG 4	
DAY _____	Choices	Consumed	Choices	Consumed	Choices	Consumed	Choices	Consumed
Feeding 1	1.		1.		1.		1.	
	2.		2.		2.		2.	
	3.		3.		3.		3.	
	4.		4.		4.		4.	
	5.		5.		5.		5.	
	6.		6.		6.		6.	
Feeding 2	Choices	Consumed	Choices	Consumed	Choices	Consumed	Choices	Consumed
	1.		1.		1.		1.	
	2.		2.		2.		2.	
	3.		3.		3.		3.	
	4.		4.		4.		4.	
	5.		5.		5.		5.	
	6.		6.		6.		6.	
DAY _____	Choices	Consumed	Choices	Consumed	Choices	Consumed	Choices	Consumed
Feeding 1	1.		1.		1.		1.	
	2.		2.		2.		2.	
	3.		3.		3.		3.	
	4.		4.		4.		4.	
	5.		5.		5.		5.	
	6.		6.		6.		6.	
Feeding 2	Choices	Consumed	Choices	Consumed	Choices	Consumed	Choices	Consumed
	1.		1.		1.		1.	
	2.		2.		2.		2.	
	3.		3.		3.		3.	
	4.		4.		4.		4.	
	5.		5.		5.		5.	
	6.		6.		6.		6.	
DAY _____	Choices	Consumed	Choices	Consumed	Choices	Consumed	Choices	Consumed
Feeding 1	1.		1.		1.		1.	
	2.		2.		2.		2.	
	3.		3.		3.		3.	
	4.		4.		4.		4.	
	5.		5.		5.		5.	
	6.		6.		6.		6.	
Feeding 2	Choices	Consumed	Choices	Consumed	Choices	Consumed	Choices	Consumed
	1.		1.		1.		1.	
	2.		2.		2.		2.	
	3.		3.		3.		3.	
	4.		4.		4.		4.	
	5.		5.		5.		5.	
	6.		6.		6.		6.	
DAY _____	Choices	Consumed	Choices	Consumed	Choices	Consumed	Choices	Consumed
Feeding 1	1.		1.		1.		1.	
	2.		2.		2.		2.	
	3.		3.		3.		3.	
	4.		4.		4.		4.	
	5.		5.		5.		5.	
	6.		6.		6.		6.	
Feeding 2	Choices	Consumed	Choices	Consumed	Choices	Consumed	Choices	Consumed
	1.		1.		1.		1.	
	2.		2.		2.		2.	
	3.		3.		3.		3.	
	4.		4.		4.		4.	
	5.		5.		5.		5.	
	6.		6.		6.		6.	
DAY _____	Choices	Consumed	Choices	Consumed	Choices	Consumed	Choices	Consumed
Feeding 1	1.		1.		1.		1.	
	2.		2.		2.		2.	
	3.		3.		3.		3.	
	4.		4.		4.		4.	
	5.		5.		5.		5.	
	6.		6.		6.		6.	
Feeding 2	Choices	Consumed	Choices	Consumed	Choices	Consumed	Choices	Consumed
	1.		1.		1.		1.	
	2.		2.		2.		2.	
	3.		3.		3.		3.	
	4.		4.		4.		4.	
	5.		5.		5.		5.	
	6.		6.		6.		6.	

(Make copies of this form, if necessary.)

DATA RECORD AND OBSERVATION SHEET

Name _____ Date _____ Period _____

The Effects of Feed Preparation on Feed Palatability and Consumption

Objective

1. What will this demonstration reveal?

2. How can students with SAE swine projects use this information?

Procedure

1. What did you do during this demonstration? (list steps)

2. Why did you change the arrangement of the feed pans at each feeding?

3. Which types of feed require the least amount of supplemental water? Why?

4. What problems could a pork producer have if feeding only liquid or paste feeds?

DATA RECORD AND OBSERVATION SHEET *(continued)*

Name _____ Date _____ Period _____

The Effects of Feed Preparation on Feed Palatability and Consumption

Observations and Results

1. Which feed type was the first and most frequent choice?

2. Describe the pigs' eating habits when moved to the feeding pens. For example: Did they completely consume a certain feed type before choosing another, or did they move from pan to pan throughout their feeding period?

3. Which feed type(s) did the pigs consume in the greatest quantities?

4. Which feed type(s) did the pigs consume in the smallest quantities?

Conclusions

List three principles you can form from your observations. Use positive statements.

Agricultural Education Science Activity - No. AS-3

Determining the Absorption Abilities of Agricultural Bedding Materials

Agricultural Subject

- Animal Science

Activity Length

- One class period

Group Size

- This activity can be conducted with small groups (8 to 10 students).

Science Principle

- **Capillary action**: This promotes absorption of liquids into unsaturated materials.

Agricultural Application

- All types of livestock require some kind of bedding. Therefore, agriculture students need a basic understanding of the nature of various types of bedding. One very important aspect of bedding is its ability to absorb moisture.

Student Objective

- To determine the absorption abilities of various agricultural bedding materials.

Vocabulary

absorption
osmosis
porosity
saturation
saturation point
bedding material

Materials Required

1. Ten five-gallon buckets
2. Water source
3. Five pounds of wheat straw
4. Five pounds of oat straw
5. Five pounds of kiln-dried wood shavings
6. Five pounds of green sawdust
7. Five pounds of shredded newspaper
8. Filter or screen
9. Scales
10. Labels
11. Stop watch or clock with second hand
12. Paper and pen for recording results

Instructional Strategies and Procedures

- **Overview**: Place five pounds of various agricultural bedding materials in separate buckets (each filled with 2 1/2 gallons of water). Allow the materials to absorb water for five minutes. Filter the materials to remove the unabsorbed water. Place the unabsorbed water in a bucket and weigh it. Record observations and discuss results.

Instructional Strategies and Procedures

(continued)

1. Obtain five pounds each of the following agricultural bedding materials:
   - wheat straw
   - oat straw
   - green sawdust
   - kiln-dried wood shavings
   - shredded newspaper
2. Obtain ten five-gallon buckets. Label them 1 through 10. Fill buckets 1 through 5 with 2 1/2 gallons (160 ounces) of water each. Weigh empty buckets 6 through 10 on a scale. Record their individual weights (in ounces) on page 3.
3. Add a portion of each bedding material to buckets 1 through 5; for example, place wheat straw in bucket 1, oat straw in bucket 2, and so on (see page 3). Continue adding bedding material to each bucket at two-minute intervals until all the material is added.
4. Allow the bedding material to remain in the buckets for five minutes.
5. Next, using a filter, strain the unabsorbed water from buckets 1 through 5 into buckets 6 through 10. For example, place the water from bucket 1 in bucket 6, place the the water from bucket 2 in bucket 7, and so on (see Figure 1). Do this at two-minute intervals until you can no longer remove any water.
6. Weigh filled buckets 6 through 10 on a scale (one at a time). Record these weights on page 3. Subtract the *empty* weight of each bucket from the weight of the filled bucket. This gives you the weight of the unabsorbed water.
7. Record the weights of the unabsorbed water on page 3 in row 1.
8. Calculate the ounces of *absorbed* water by subtracting the number of unabsorbed ounces in row 1 from 160 ounces (amount of water originally in buckets 1 through 5.) Record this weight on page 3 in row 2 of the chart.

■ **Results**: The shredded paper absorbed the most water followed by dry shavings, wheat straw, oat straw, and finally sawdust (least absorbent). Figure 2 illustrates the *approximate* amounts of unabsorbed water you can expect.

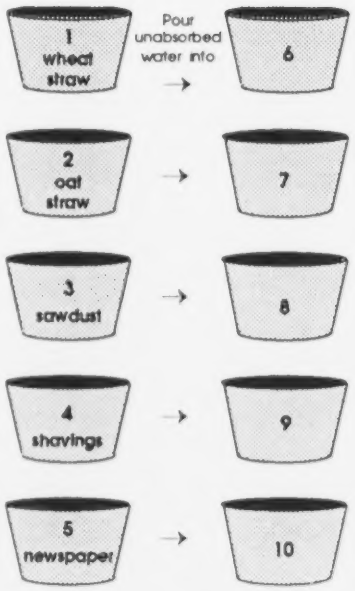

Figure 1. Pour unabsorbed water into buckets as indicated here.

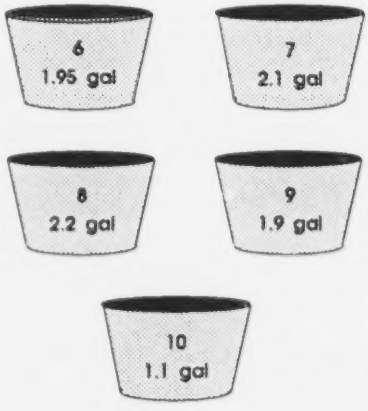

Figure 2. These buckets represent the amount of water unabsorbed by the various beddings. Compare your findings to these *approximate* expected results.

Key Questions

1. Which bedding material is most absorbent?
2. Which bedding material is most practical to use?
3. Which bedding material is least absorbent?
4. Do your findings agree with the expected results?

Evaluation

■ If two or more small groups are conducting this activity, compare their results.

This demonstration was submitted by Jim Snavley, Production Agriculture Instructor, Upper Scioto Valley High School, McGuffey, OH 45859.

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DATA RECORD AND OBSERVATION SHEET

Name _____ Date _____ Period _____

Determining the Absorption Abilities of Agricultural Bedding Materials

Objective

Procedure

Observations and Results

	BUCKET 1 Wheat Straw	BUCKET 2 Oat Straw	BUCKET 3 Sawdust	BUCKET 4 Shavings	BUCKET 5 Newspaper
	(Empty weight of bucket 6 _____) (Filled weight of bucket 6 _____)	(Empty weight of bucket 7 _____) (Filled weight of bucket 7 _____)	(Empty weight of bucket 8 _____) (Filled weight of bucket 8 _____)	(Empty weight of bucket 9 _____) (Filled weight of bucket 9 _____)	(Empty weight of bucket 10 _____) (Filled weight of bucket 10 _____)
1 **Ounces of unabsorbed water** (Subtract weight of empty bucket from weight of filled bucket)					
2 **Ounces of absorbed water** (Subtract oz. of unabsorbed water from 160 oz.)					

Conclusions

Agricultural Education Science Activity - No. AS-4

Comparing and Contrasting Plant and Animal Cells

Agricultural Subject

- Animal Science

Activity Length

- One class period

Group Size

- This activity can be conducted in small groups (two to three students).

Science Principles

- **Genetics**: All organisms resemble their parents to a certain degree, but they also differ in some ways. These similarities and differences depend on the interaction and/or segregation of genes, environmental factors, and the occurrence of mutations.

- **Classification**: Organisms are classified according to their structural and functional similarities.

Agricultural Application

- Cells are the building blocks of an organism. They contain the materials necessary for the organism to function. However, not all cells are alike. Therefore, agricultural students need a basic understanding of cell characteristics and functions in order to differentiate between plant and animal cells.

Student Objective

- To determine the differences and similarities between plant and animal cells.

Vocabulary

cytoplasm
protoplasm
nucleus
genetics
organelle
chloroplast
vacuoles
cell wall
cell membrane
centriole

Materials Required

1. Microscope
2. Two or more glass slides and coverslips per group
3. Animal cells (scraping of cheek lining)
4. Plant cells (onion cut in small pieces)
5. Toothpicks (flat edge)
6. Tweezers
7. Iodine stain (1 g potassium oxide and 0.5 g iodine in 100 ml distilled water)
8. Eyedropper
9. Paper and pen for recording results

Instructional Strategies and Procedures

- **Overview**: Observe animal and plant cells under a microscope. Note the similarities and differences of each cell type. Discuss how each cell functions and how it benefits from its particular structure. Reocrd observations.

Instructional Strategies and Procedures

(continued)

ANIMAL CELLS

1. Using an eyedropper, place one drop of iodine stain on a clean glass slide.
2. Using the flat end of a toothpick, lightly scrape the inside lining of your cheek (animal cells).
3. Now dip the end of the toothpick in the iodone stain on the slide. Swirl the toothpick to remove the scrapings. Place a coverslip on the stain and position the slide under a microscope.
4. Observe the scrapings using low power; observe the scrapings using high power. Compare what you see to Figure 1.

PLANT CELLS

5. Snap a small chunk of onion in two pieces. This produces a tissue-thin layer at the breaking point of the onion.
6. Remove this thin layer (plant cells) with tweezers and place it on a clean glass slide. Unfold any bent edges.
7. Using an eyedropper, place several drops of iodine stain on the onion layer. Place a coverslip on the stain and position the slide under a microscope.
8. Observe the onion layer using low power; observe the onion layer using high power. Compare what you see to Figure 2.

■ **Results**: You see that each animal cell contains a vacuole, cell membrane, organelles, cytoplasm, nucelus, and centrioles. Each plant cell contains a nucleus, vacuole, cell membrane, cell wall, cytoplasm, chloroplasts, and organelles.

Key Questions

1. What cell parts are found in both plant and animal cells?
2. What cell part is not found in onion cells, but found only in animal cells?
3. What are some benefits that could result from the detection of differences between animal and plant cells?

Evaluation

■ Ask students to demonstrate what they have learned by sketching and labeling a plant cell and an animal cell.

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1. Scott, et al. *Biology*. Glenview, IL: 1980.
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Experiment submitted by Sue Haddix, Production Agriculture Instructor, London High School, London, OH 43140.

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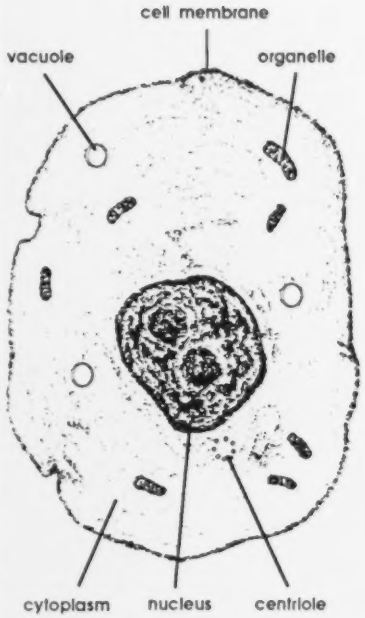

Figure 1. Microscopic view of an animal cell.

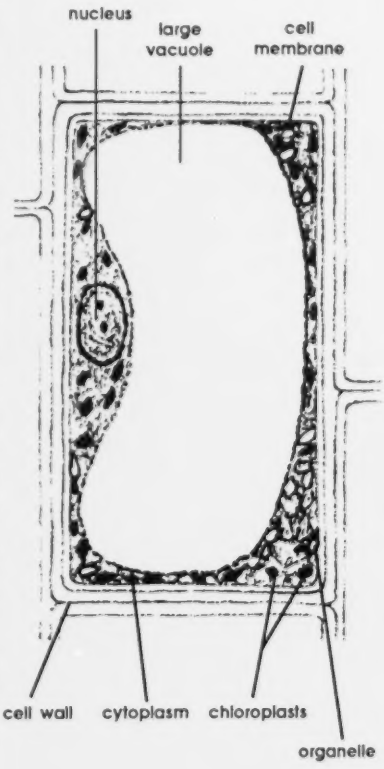

Figure 2. Microscopic view of a plant cell.

DATA RECORD AND OBSERVATION SHEET

Name _____ Date _____ Period _____

Comparing and Contrasting Plant and Animal Cells

Objective

Procedure

Observations and Results

Conclusions